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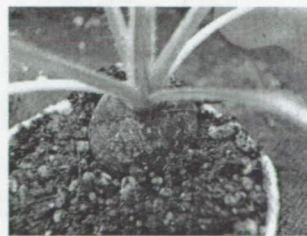
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Comparison of spectral combinations of light emitting diodes for crop production

Presented by: Crystal Dillard
Authors: C. Dillard, A. Eldemire,
O. Monje, J. Sager

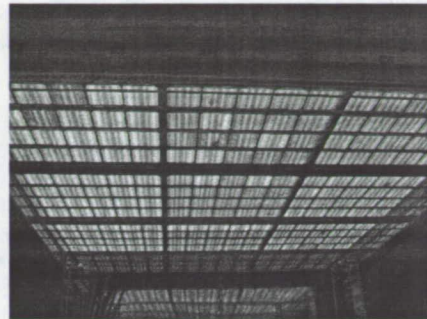
Introduction

- Need a fresh food source for long term space missions
 - Nutrition
 - Psychological benefit of growing plants
- Salad crops
 - Previous studies done on lettuce
 - Radishes used in this experiment



Why LEDs?

- Lower mass and volume
- Longer life
- Power savings
 - Lower power consumption
 - Run on DC Power
 - Lower levels of thermal radiation
- More safe than fluorescent lamps

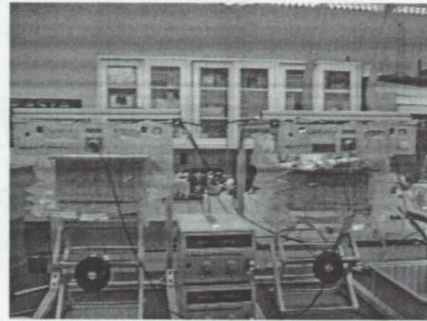


Lighting Treatments

Parameter	Light Treatment			
Photon flux ($\mu\text{mol m}^{-2} \text{s}^{-1}$)	RB	RGB	Fluor.	RGB+Fr
PPF (400-700nm)	206	207	210	209
Total (350-1100nm)	207	208	232	221
Fraction (%)	RB	RGB	Fluor.	RGB+Fr
PPF	100%	100%	91%	94%
Blue	7.0%	9.0%	9.0%	10%
Green	1.0%	8.0%	35%	8.0%
Red	92%	82%	46%	76%
Far-red	0.10%	0.10%	6.0%	6.0%

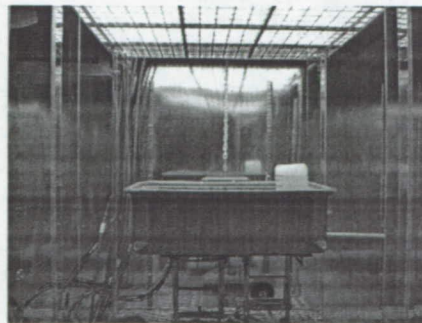
Materials (RB vs. RGB)

- Orbitec Veggie Unit
 - 3 LED array (RGB)
 - Fans
 - Plastic bellowed walls
- Chiller to control humidity
- CO₂ control system



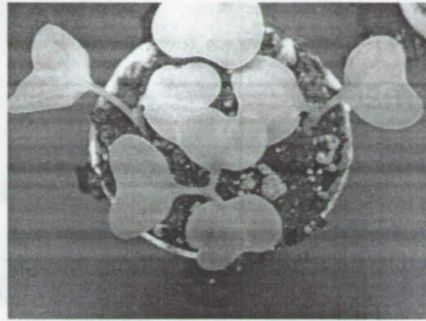
Materials (RGB vs. RGB+Fr)

- M-12, EGC
- Orbitec 6-LED array
- Plastic Trays
- Trays support by a metal jack
- Watering bottle and mat

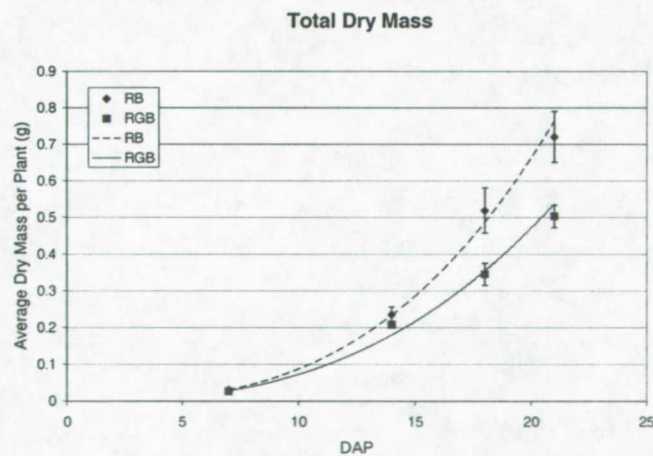


Plant Conditions

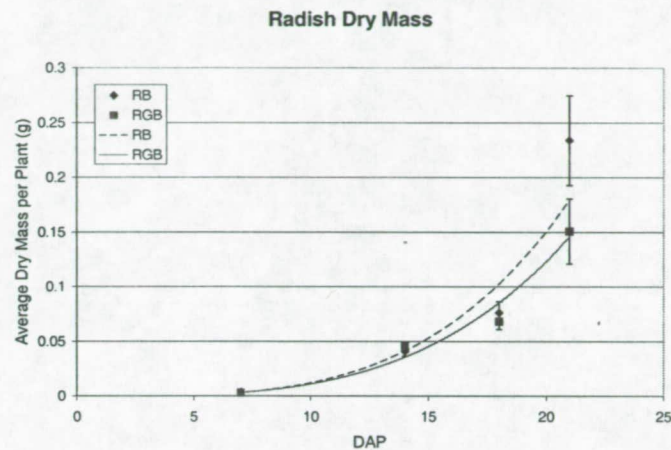
- Soil – mixture of peat, perlite, and vermiculite
- Osmocote fertilizer
- 4 seeds to a cup
- 12 cups to a tray
- Thinned at 7 DAP
- Harvests at 7, 14, 18, and 21 DAP



Total Dry Mass (RB vs. RGB)

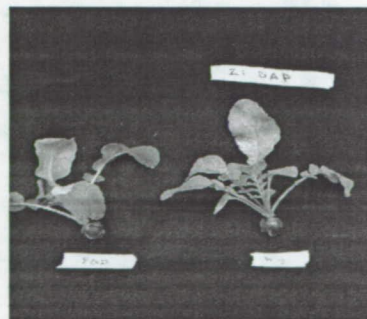


Radish Dry Mass (RB vs. RGB)

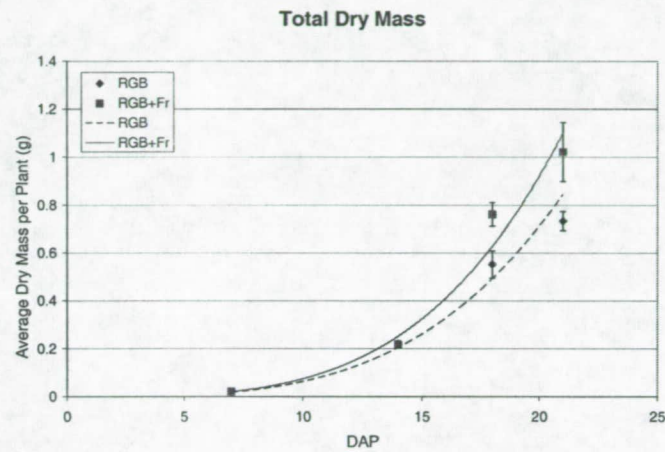


RB vs. RGB Discussion

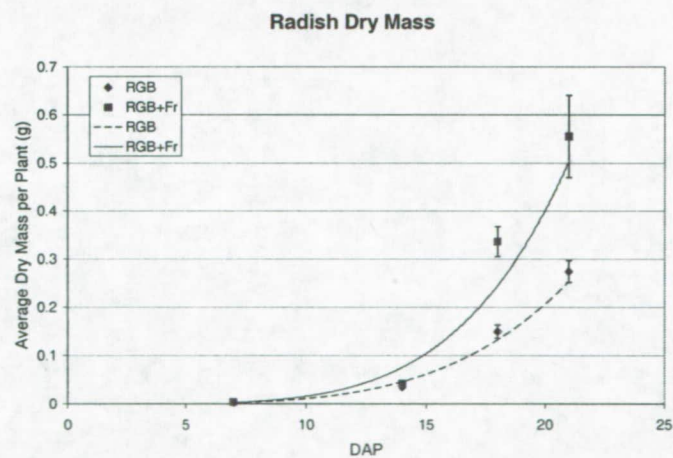
- Both light treatments grew healthy plants
- Green light makes plants look normal but comes at a cost
- Further study to determine cause of smaller plants in RGB chamber



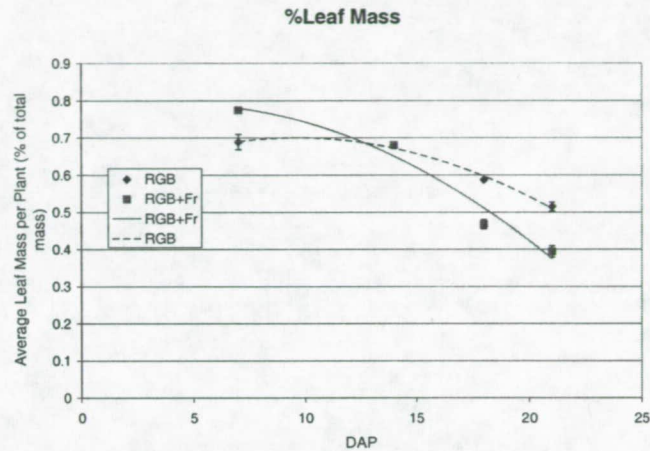
Total Dry Mass (RGB vs. RGB+Fr)



Radish Dry Mass (RGB vs. RGB+Fr)

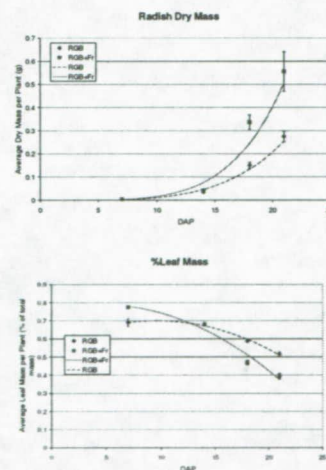


Percentage Dry Leaf Mass (RGB vs. RGB+Fr)



RGB vs. RGB+Fr Discussion

- Both light treatments grew healthy plants
- Adding Far-red light caused plants to dedicate more mass to the radishes
- RGB+Fr also saw a greater decrease in % dry leaf mass, leading to a smaller waste to radish ratio



Conclusions

- LEDs are a good photosynthetic light source for plants
- Because of there many benefits over fluorescent lights, LEDs would be preferred in places of limited space and power
- Due to the marked difference in radish size in the RGB vs. RGB+Fr experiment it is clear that spectral quality has a great effect on plant development

Future Work

- Find optimum spectra for growing radishes
- Compare spectral effects on radishes with similar studies on lettuce and spinach
- Explore the effect of other environmental parameters on plant growth such as CO₂ levels

Thank You for Coming

Any Questions?